

NASA Ames DEVELOP Interns: Helping the Western United States Manage Natural Resources One Project at a Time

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The western half of the United States is made up of a number of diverse ecosystems ranging from arid desert to coastal wetlands and rugged forests. Every summer for the past 7 years students ranging from high school to graduate level gather at NASA Ames Research Center (ARC) as part of the DEVELOP Internship Program¹. Under the guidance of **Jay Skiles** [Ames Research Center (ARC) – *Ames DEVELOP Manager*] and **Cindy Schmidt** [ARC/San Jose State University – *Ames DEVELOP Coordinator*] they work as a team on projects exploring topics including: invasive species, carbon flux, wetland restoration, air quality monitoring, storm visualizations, and forest fires. The study areas for these projects have been in Washington, Utah, Oregon, Nevada, Hawaii, Alaska and California. Interns combine data from NASA and partner satellites with models and *in situ* measurements to complete prototype projects demonstrating how NASA data and resources can help communities tackle their Earth Science related problems.

Invasives Threaten Western Ecosystems

Invasive plants and animals can become a serious threat to ecosystems by consuming resources that native species need to survive, including water, nutrients, and space. During the Summer of 2003 a team of interns worked with the Pyramid Lake Paiute Indian Tribe located in Nevada to map the spread of *Lepidium latifolium* also known as Tall White Top or Perennial Pepperweed. They also created a model to predict the future spread under two scenarios: intensive weed management practices and unmanaged.

Another way invasive species can be detrimental to surrounding plant communities is to render the environment inhospitable to native plants. *Tamarix ramosissima*, common name Tamarisk or Salt Cedar, has invaded riparian ecosystems in much of the Southwest. By secreting salt from its leaves Tamarisk can redistribute salt from the soil profile to the soil surface inhibiting germination and growth of other plant species. A project done by DEVELOP interns in 2008 took place in Utah where there is an ongoing study relating to the use of a beetle, *Diorhabda elongata* or the tamarisk beetle, as a bio-control for Tamarisk. Interns used Landsat data to analyze the feasibility of using remote sensing to monitor the spread of the beetles. Tamarisk defoliation and decreased plant health are the primary indicators of beetle presence and can be detected with remote sensing imagery. They also used the vertical salt profile and other *in situ* data to produce habitat suitability maps for tamarisk and the beetle in Dinosaur National Monument.

Protecting Pacific Rim Ecosystems

¹ To read more about the DEVELOP program, see pages 7-9 in The Earth Observer's March-April 2010 issue [**Volume 22, Issue 2**], pages 11-13 in the May-June 2010 issue [**Volume 22, Issue 3**], and pages 10-12 in the July-August 2010 issue [**Volume 22, Issue 4**].

Ames DEVELOP interns have also conducted studies in the Alaska and Hawaii regions. In 2006, the International Polar Year, a team of interns worked with Synthetic Aperture Radar and Moderate Resolution Imaging Spectroradiometer (MODIS) data to characterize ice thickness in the Yukon-Kuskokwim Delta region, Alaska. These data were then compared with airborne thermal imagery of Pacific walrus (*Odobenus rosmarus divergens*) populations. The results of their study suggest that walrus prefer medium and some thin ice floes, possibly for predator avoidance purposes. These insights can be useful for the conservation and stewardship of the walrus.

Cyclones and typhoons in the Pacific Ocean cause large amounts of destruction every year, and are equivalent in size and strength to hurricanes experienced along the Atlantic and Gulf coasts of the United States. Scientists from NOAA and other countries around the Pacific Basin are studying past storms in order to better prepare for future storm events. In 2007 NOAA asked Ames DEVELOP to create a series of geo-visualizations of major storm and high water events that could be incorporated into the Pacific Region Integrated Climatology Information Products (PRICIP) Portal. Interns spent the Summers of 2007 and 2008 incorporating storm tracks with surface wind speed and direction, precipitation accumulation, sea surface temperature, and sea surface height data, from Quick Scatterometer (QuikSCAT), Tropical Rainfall Measuring Mission (TRMM), Jason-1, and Aqua.

Fighting Fire with Fire: Remote Sensing for Forest Management

Forest Managers have to consider a wide range of issues, such as: carbon budgets, fires, and forest health in their decision-making processes. Located in southern Oregon, the Fremont-Winema National Forest's timber is harvested yearly, both for monetary return and to reduce standing fuel load. During the Summer of 2004 DEVELOP interns studied how tree harvesting and wildfires could affect the carbon budget using Landsat, and *in situ* data, along with FlamMap and NASA Carnegie-Ames-Stanford-Approach (CASA) models. It was determined, based on their inputs to the NASA-CASA model, regardless of how long a forest is left to regenerate after selective-cuts, Net Ecosystem Productivity will not equal pre-fire productivity if timber is harvested. Additionally they produced fire rate-of-spread and flame length maps to highlight areas of high risk for severe fires.

According to the National Park Service Yosemite National Park was host to 3.7 million visitors in 2009. Leaf Area Index (LAI) is one of several indices derived from satellite imagery that are used to monitor forest health. In 2006 interns mapped unexplained Leaf Area Index (LAI) anomalies to aid the National Park Service in monitoring ecological disturbances. MODIS LAI data were processed by the Terrestrial Observation and Prediction System (TOPS) model from 2001-2005. Known areas of insect infestations, snow cover, and recent wild fires were removed. The resulting map showed areas where additional investigation was needed to improve the understanding of the anomalies.

Fire suppression was a common practice in forest management until recently. This has led to a high build up of fuels on the forest floor and thus an increase in fire severity. In 2008 a DEVELOP team performed a burn severity assessment on the Tripod Complex fire. This fire

burned 175,000 acres in 2006 in the Okanogan-Wenatchee National Forest, Washington. The interns combined *in situ* data with data from Landsat and MODIS imagery to create a burn severity map. These data have since been used to inform additional studies relating to the impact of the Tripod Fire.

As the 10-week intensive summer projects end, the results are handed off to the partners, allowing them to make new decisions about the topic with completed maps, data sets, and results. The interns are also given the opportunity to present the results at conferences such as American Society of Photogrammetry and Remote Sensing (ASPRS) and American Geophysical Union (AGU). The DEVELOP internship program not only provides valuable research experience to the students, but also provides an important community resource. Local, statewide, tribal, and national partners have benefited from DEVELOP's projects with an impressive set of data and information provided to them in such a short time-line; this allows not only for a rapid assessment of data but also a new resource as a policy-making tool.

If you have any questions about other project Ames DEVELOP interns have completed or the DEVELOP internship program in general you can visit *develop.larc.nasa.gov*.



Douglas Gibbon collecting data during the summer of 2003 surrounded by Tall White Top in Nevada.



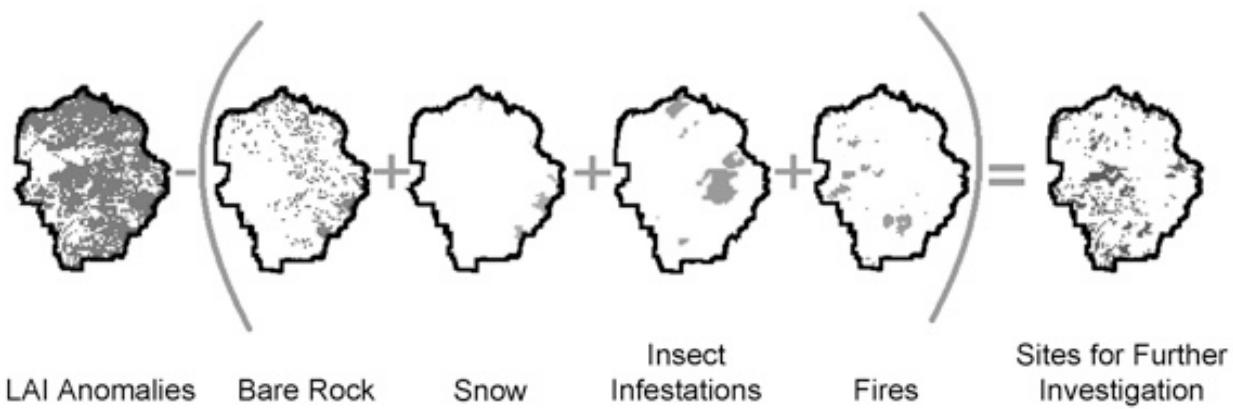
The presence of tamarisk being documented by Vanessa Archambault while rafting down the Green River in Dinosaur National Monument, Utah with her team in 2008.



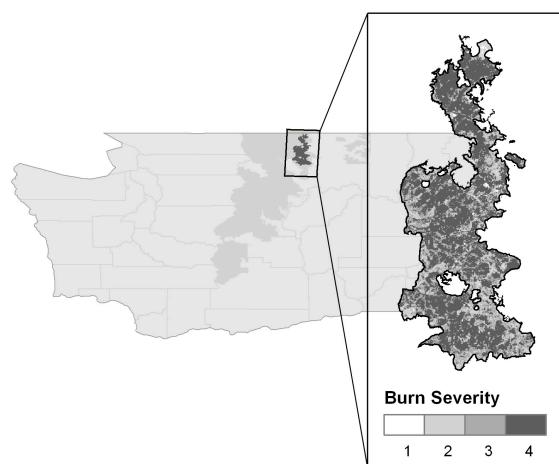
Supriya Iyer presenting her team's poster and animations at the American Geophysical Union Conference in San Francisco, December 2008.



Casey Cleve taking a soil sample to be analyzed for carbon in the Fremont-Winema National Forest, Oregon during the summer of 2004.



A visual representation of steps taken to remove known causes of LAI anomalies in Yosemite National Park. The final map highlights sites for further investigation from the 2006 study.



Burn Severity classification of the Tripod Complex Fire in Washington State produced by a team during the summer of 2008.